NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

THE APPLICATION OF SECURITY CONCEPTS
TO THE PERSONNEL DATABASE FOR
THE INDONESIAN NAVY

by

Mulyo Wibisono

September 1983

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This thesis is a continuation of the study work done by Moedjiono (M.S. thesis, Naval Postgraduate School, 1982) concerning personnel database in the Indonesian Navy.
It discusses the current database security and the concept of Multics (Multiplexed Information and Computing System) to propose a personnel database security model in the Indonesian Navy.

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The Application of Security Concepts to the Personnel Database for the Indonesian Navy

by

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Submitted in partial fulfillment of the requirements for the degree of

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ABSTRACT

This thesis is a continuation of the study work done by Moedjiono (M.S. thesis, Naval Postgraduate School, 1982) concerning personnel database in the Indonesian Navy.

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I. INTRODUCTION

This thesis is a continuation of the thesis " The Preliminary Personnel Data Base Design for the Indonesian Navy ", by Moedjiono at the Naval Postgraduate School, Monterey, California, June 1982.

Since 1977, the Indonesian Navy Data Center (DISPULAHTAL) has collected and processed personnel data to support the leadership in the Navy in their decision making. In 1980 work began on the design of personnel database system. Computerization of personnel data took place only within the Department of Personnel and was limited to administrative purposes. However, other departments in the Navy, such as Intelligence, Operations, Logistics, and Planning , had to work with an increasing and more complex amount of data. With every department maintaining its own personnel data there were discrepancies. Information was often incomplete or uniformly updated, since not all departments received data changes. The increasing availability of data, and the importance of timely decision-making emphasized the need to establish a computer system which could accommodate these needs.

Since information is a recognized source of economic value, the data wich comprise the information should be secured adequately. E. B. Fernandez [Ref. 5] defines information as:

> a critical resource in today's enterprises, whether they are industrial, commercial, educational, or civic.
>
> Information has been widely recognized as a resource of economic value to an enterprise.

This thesis proposes to continue the design work of a personnel database system begun in 1980.

As the use of computers increases, the number of people who might have access to confidential information also increases, emphasizing the importance of access security. In the military, a leakage of information could endanger national security. Data on secret weapons, numbers and distribution of personnel, emergency procedures, and personnel background are important to the enemy. Internally, misuse of data may result in corruption of totals of data in compiling salary lists or theft of secret information for use by the enemy. The absence of any type of data protection may lead to unintentional errors by an operator resulting in the destruction or damage of data. Natural disasters also may destroy information or data. Damaged information may lead to inaccurate decisions, which may jeopardize national security.

To prevent the above mentioned problems, it is essential to provide protective mechanisms to database systems. In other words, there is a need for database security.

In view of the developments of personnel database in the Indonesian Navy and the absence of protective mechanisms, this thesis propose a concept to provide security for data that will be the basis for decisions made by the leadership of the Navy.

There are many varieties of database types, but this thesis will be limited to the security of personnel database. The six sections of this thesis are:

I. Introduction.

II. The current proposed personnel database systems

III. The needs for security protection.

IV. The Multics concepts.

V. Implementation of Multics in database security.

VI. Conclusions and Recommendations.

This personnel database security concept will be a contribution to the security of computerized data processing in the Indonesian Navy.

II. THE CURRENT PROPOSED PERSONNEL DATABASE SYSTEM

The present Database systems [Ref. 3] have the following objectives:

- Reducing redundancy
- Sharing of data
- Avoiding inconsistency
- Enforcing standards
- Maintaining integrity, and
- Balancing of conflicting requirements.

This database contains 97 data elements divided into two [Ref. 10.] basic groups:

1. Static data elements.
2. Dynamic data elements.

A. STATIC DATA ELEMENTS

Static data elements consist of data that will not change frequently.

For example:

Main Identification constitutes a group by itself containing the elements numbered 101 to 108. Data elements rarely retrieved by applications programs are entered into Personnel Characteristic (element # 200) which in turn are divided into the following four sub-groups:

1. Marriage subgroup (element # 300) containing elements numbered 301 and 302.
2. Address subgroup (element # 400) containing elements numbered 401 to 403 .

3. Body characteristic subgroup (element # 500) containing elements numbered 501 to 511.
4. Category and Status subgroup (element # 600) containing elements numbered 601 to 607.

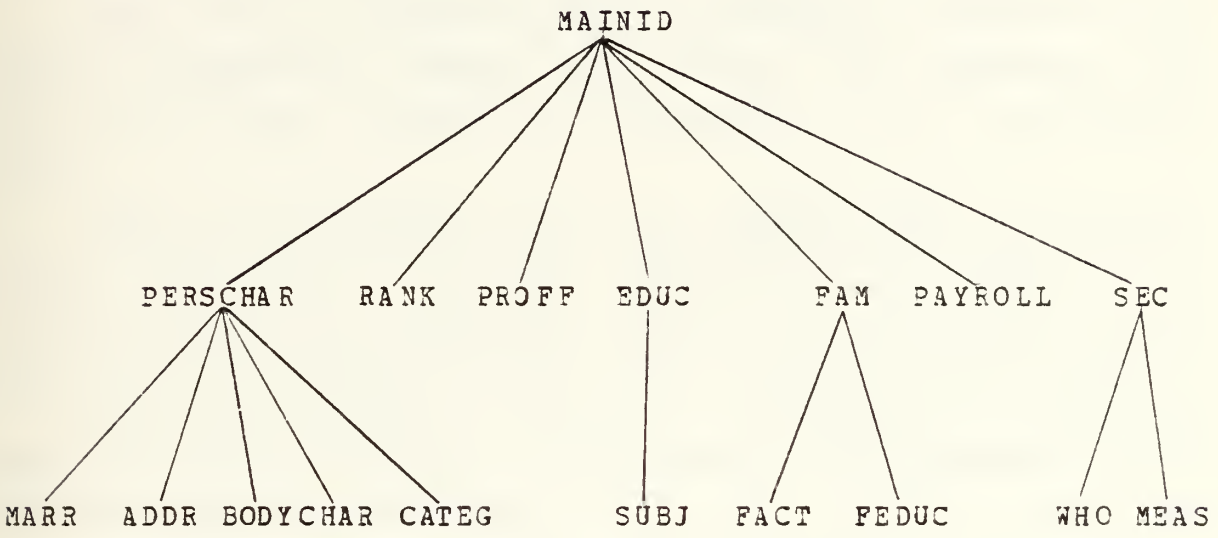
B. DYNAMIC DATA ELEMENTS.

Dynamic data elements are those which are frequently changed. They are divided into several subgroups corresponding to their historical data. These groups include:

1. Rank group (element # 700) containing elements numbered 701 to 707.
2. Profession group (element # 800) containing elements numbered 801 to 810.
3. Education group (element # 900) containing elements numbered 901 to 909.
4. Education group (element # 1100) containing elements numbered 1101 to 1106. This group is divided into two subgroups:
   a. Activity and profession subgroup (element # 1200) containing elements numbered 1201 to 1204.
   b. Family education subgroup (element # 1300) containing elements numbered 1301 to 1303.
5. Payroll group (element # 1400) containing elements numbered 1401 to 1414.
6. Security group (element # 1500) containing elements numbered 1501 to 1506. This group is divided into the following two(2) subgroups:
   a. Who involved subgroup (element # 1600) containing elements numbered 1601 to 1603.
   b. Measures subgroup (element # 1700) containing element numbered 1701 to 1703.

(For complete overview of element numbering see Appendix A.)

The above database system forms a hierarchy as illustrated in the model below:



III. THE NEED FOR SECURITY PROTECTION

A. GENERAL APPROACH

The use of automated data processing equipment has become widespread because it permits the handling and storage of vast amounts of information at an affordable cost.

The military benefits from the use of computers include speed and accuracy of data collection which results in timely and improved decisions. Beside these advantages a new hard-to-solve problem emerges, that of information security.

The basic problem is illustrated in Figure 3.1 Users and data at various security levels desire simultaneous access to the machine's resources.

Data with all security levels are stored on the system. Users with proper security credentials are granted data accesses. Navy security policy requires that an individual must possess the required non-discretionary[1] and discretionary[2] privileges before being granted access to the information.

In fact, application of computers in Indonesia is new, so careful considerations should accompany the design and implementation of the basic concepts of database security.

---

[1] Non-discretionary security requires that the individual has a security clearence of higher or equal level than the level of the information requested.

[2] Discretionary security requires that the individual possesses a proper need-to-know for requested information

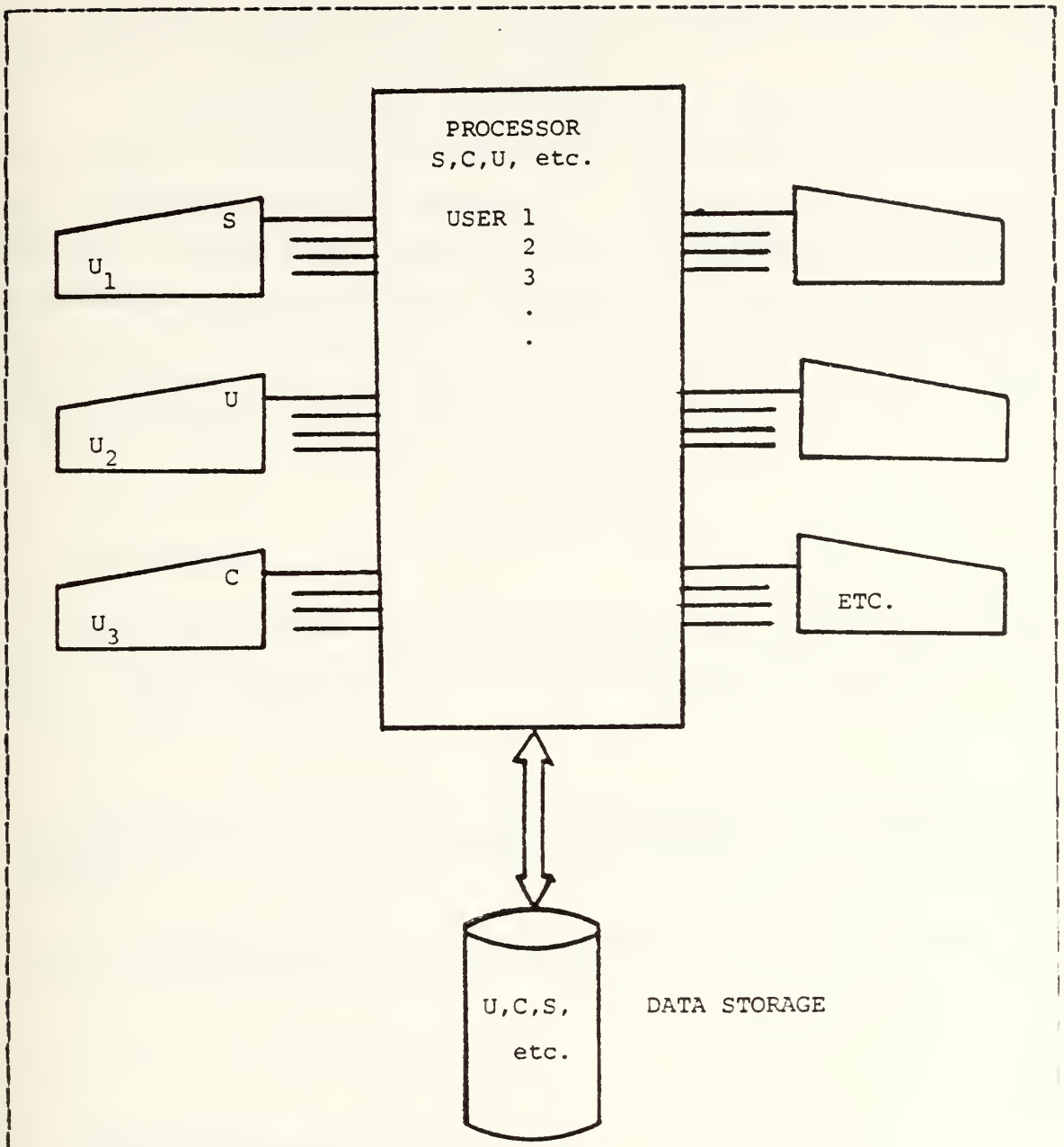


Figure 3.1 Problem Description.

Frequent foul play often takes place because of the lack of protection when using computer systems, as well as protection of the database systems.

In the military, particularly, information is very important. Leakage or corruption of military information could endanger national security. Information about secret weapons, numbers and distribution of personnel, emergency procedures, and personnel background /data are all very important to the enemy. On the other hand, for authorized users updated data is very important since an error in the data may produce faulty decisions.

B. DEFINITIONS

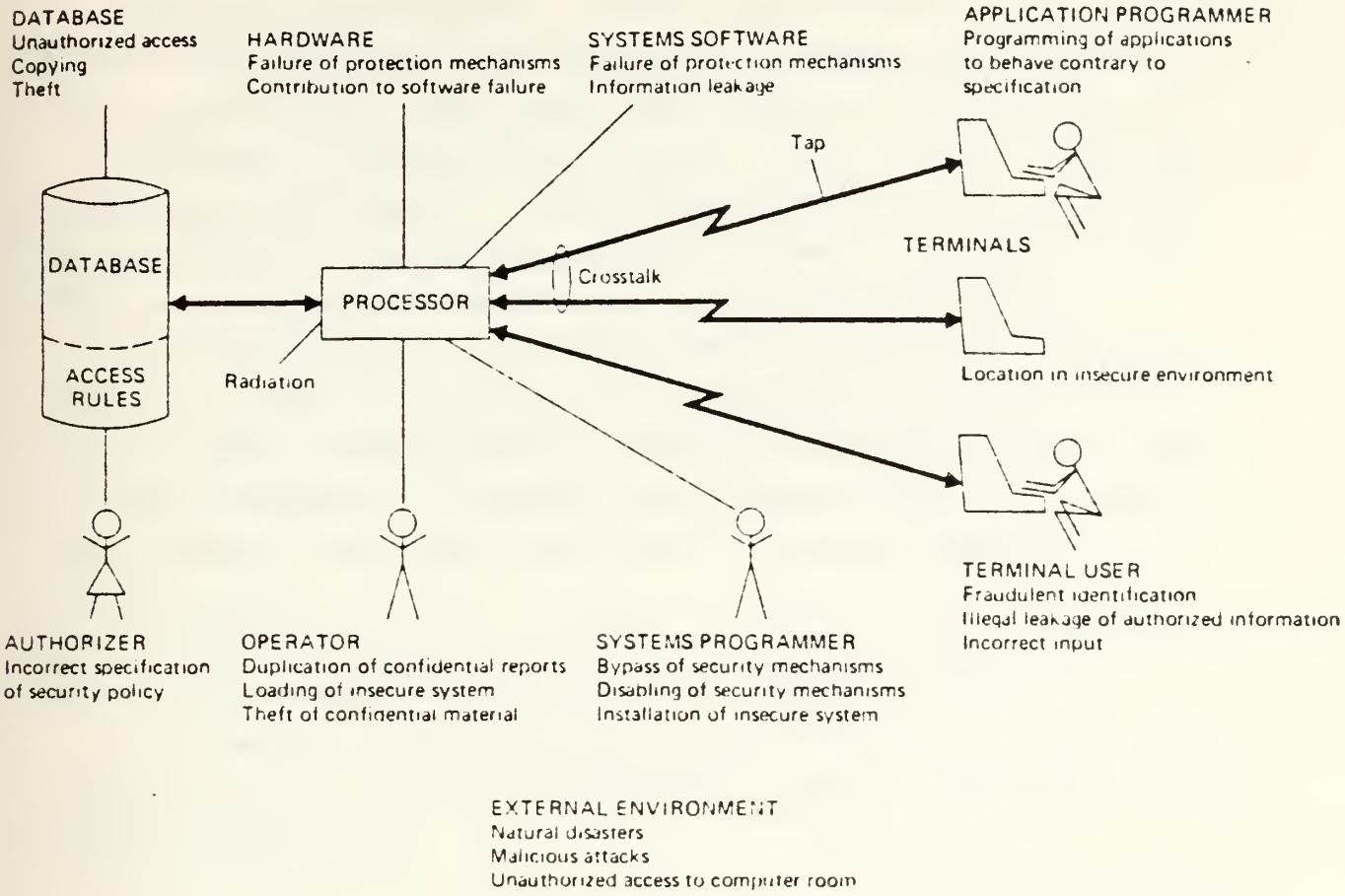
Many definitions are used in database security. The most widely used definitions according to Fenandez E.B. (1981) [Ref. 5] are:

" Information security is the protection of information against unauthorized disclosure, alteration, or destruction."

" Database security is the protection of information that is maintained in a database."

C. SECURITY THREATS

A database security violation may take form as unauthorized reading, modification, or destruction of information stored in the database. Possible threats to the security of a computer system may be broadly classified as either malicious or accidental acts.



From:
Database Security & Integrity
By E.B. Fernandez

Figure 3.2 Security Threats.

In Figure 3.2 , we see the possibility of a malicious conduct by exploiting loopholes in the system. There are also threats resulting from human errors, such as accidentally destroying information, or allowing it to be seen by unauthorized people. In addition, natural disasters may destroy or prevent access to information. These threats are classified as nonmalicious threats.

D. SECURITY PROCEDURES AND MECHANISMS

Security threats arise from a wide variety of sources, therefore procedures and mechanisms necessary to provide a secure environment must cover many areas of the enterprise.

External procedures must be set up so that security mechanisms implemented within the system can be effective. We must select personnel who have access to highly classified information through security clearance procedures.

Storage devices and other hardware must be physically protected against any damage from natural disasters or malicious attack. Protection of removable storage against theft is also necessary. We also need backup systems for copying data files at different locations to protect against information loss.

Information may be stolen or tapped during transmissions, and encryption is one way to protect this data.

In summary, the security of a database depends on a complex set of protective measures: human, software, and hardware [Ref. 14].

E. SECURITY POLICIES

An access-control[3] system determines the way a subject[4] may access[5] data or objects.[6]

---

[3]Access-control. A strategy for protecting objects from unauthorized access.

[4]Subject. An active user of a computer system together with any other entity acting on behalf of a user or on behalf of the system; for example, processes, jobs, and procedures may be considered subjects. Certain subjects may also be considered to be objects of the system.

[5]Access. The ability and the means necesary to store or retrieve data, to communicate with, or otherwise make use of any resource in a computer system.

[6]Object. In a formal security model, an identifiable resource, data container or related entity of the system; the counterpart of subject. Software-created entities such

There are many kinds of access-control policies and they depend upon the categories of information and the positions of the users (subjects).

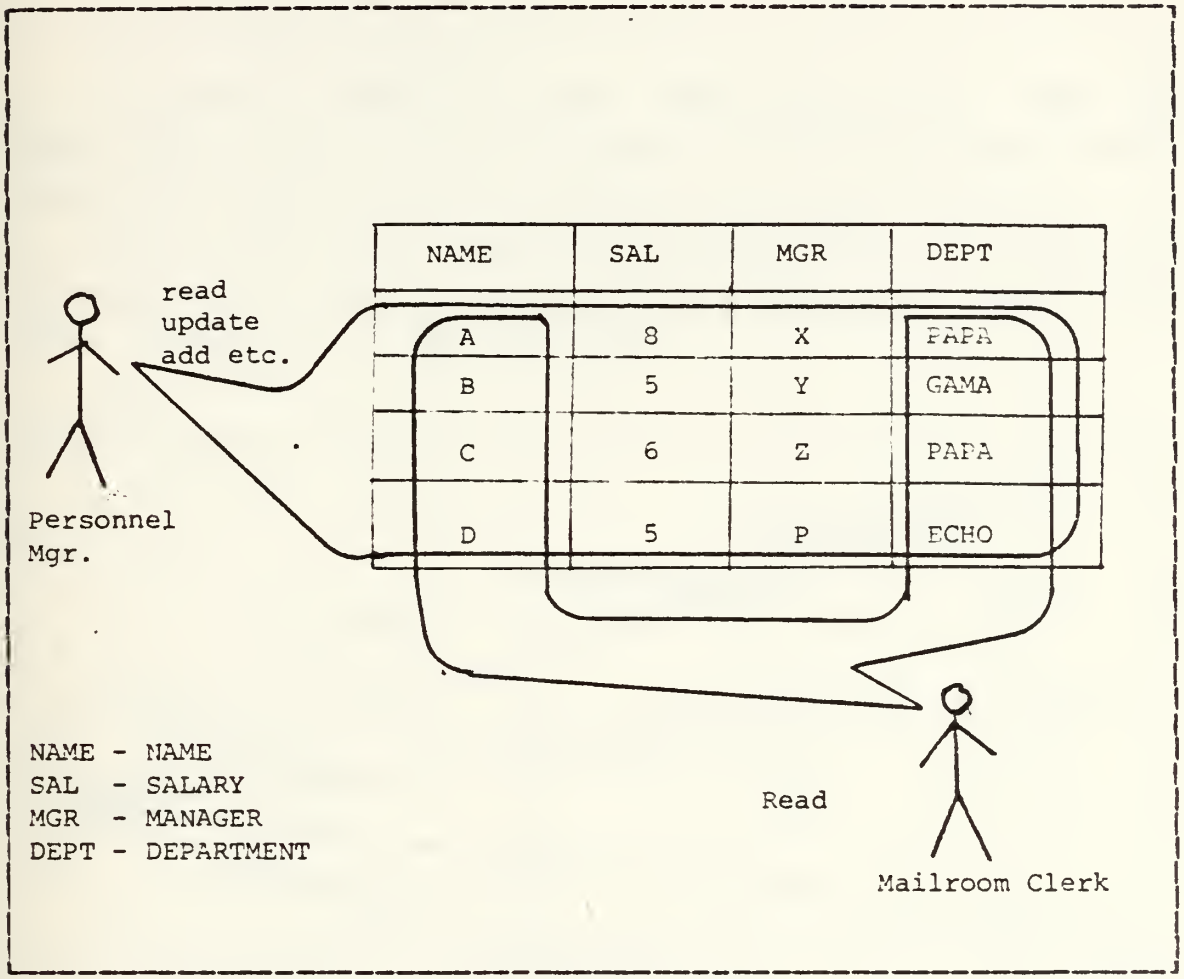


Figure 3.3 Access-type-dependent Access Control.

Figure 3.3, shows a situation where not everybody can see the whole file. Users are given access to the file, according to their position.

---

as files, programs and directories are objects, as well as hardware resources such as memory blocks, disk tracks, terminals, and tapes.

An access can be of several forms:

r - read
w - write
a - append
d - delete, and
e - execute

An execute access is often used but omitted from this model due to the fact that execute access in the proposed protection architecture is similar to a read access.

To be qualified to access specific data, a user must conform to the military security conventions of classification, category, and need-to-know.

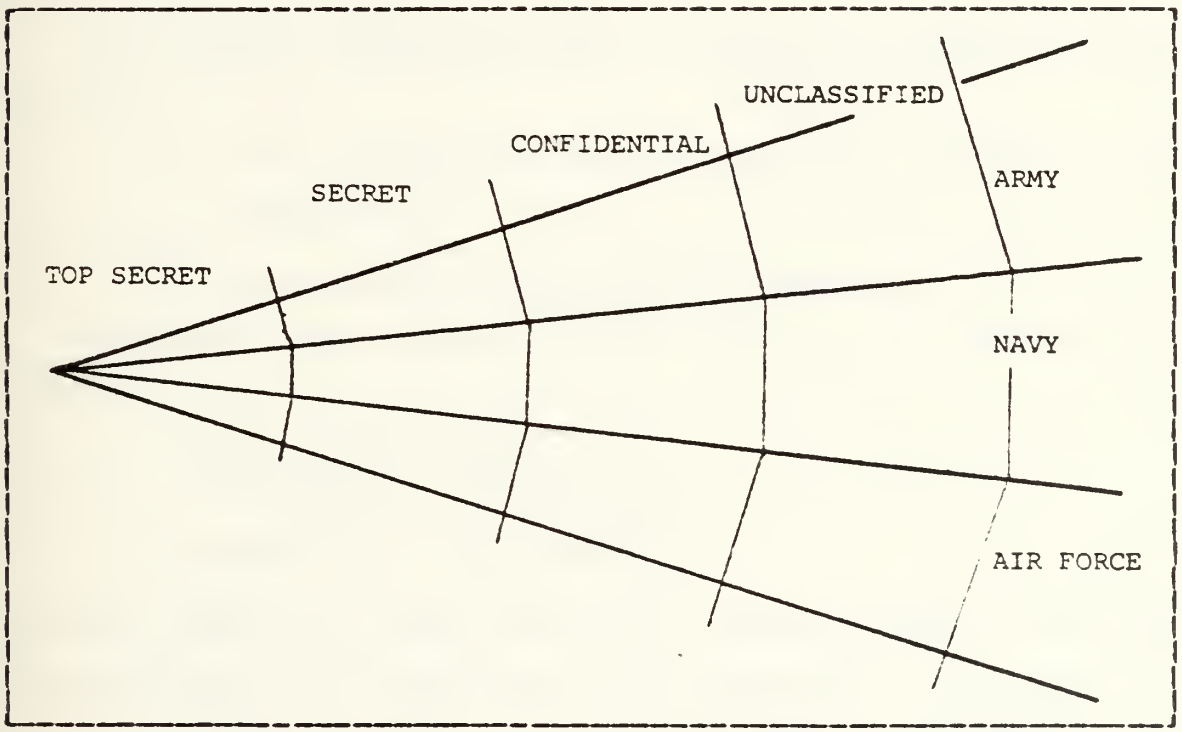


Figure 3.4 Combination of Compartment and Levels.

In military, for example, the Army, Navy and Air Force have different kinds of categories of files ranging from top secret to unclassified files. Thus by a combination of

compartmentalization and levels, a good policy for control information flow can be created.

F. MULTILEVEL MODEL

This model introduces the concept of levels and categories. Each subject is assigned a clearance level, and each object is assign a classification level. Every person in the military has different security levels that permit how far (s)he may access the file and how much (s)he can see the file. Therefore a security level is a composite of: { A, B }, where A is the classification level and B is the set of categories.

One security level is said to dominate another if and only if:

1. its classification or clearance level > the other, and

2. its category set contains the other.

Clearance and classification levels are ordered as follows:

top secret > secret
secret > confidential
confidential > unclassified

Security levels are only partially ordered however, so that some subjects and objects are not comparable. In Figure 3.5 , L2 is dominated by L1, since its level of classification and its set of categories is higher. On the other hand security levels of L1 and L3, are not comparable. The elements of the above model are summarized in Figure 3.6

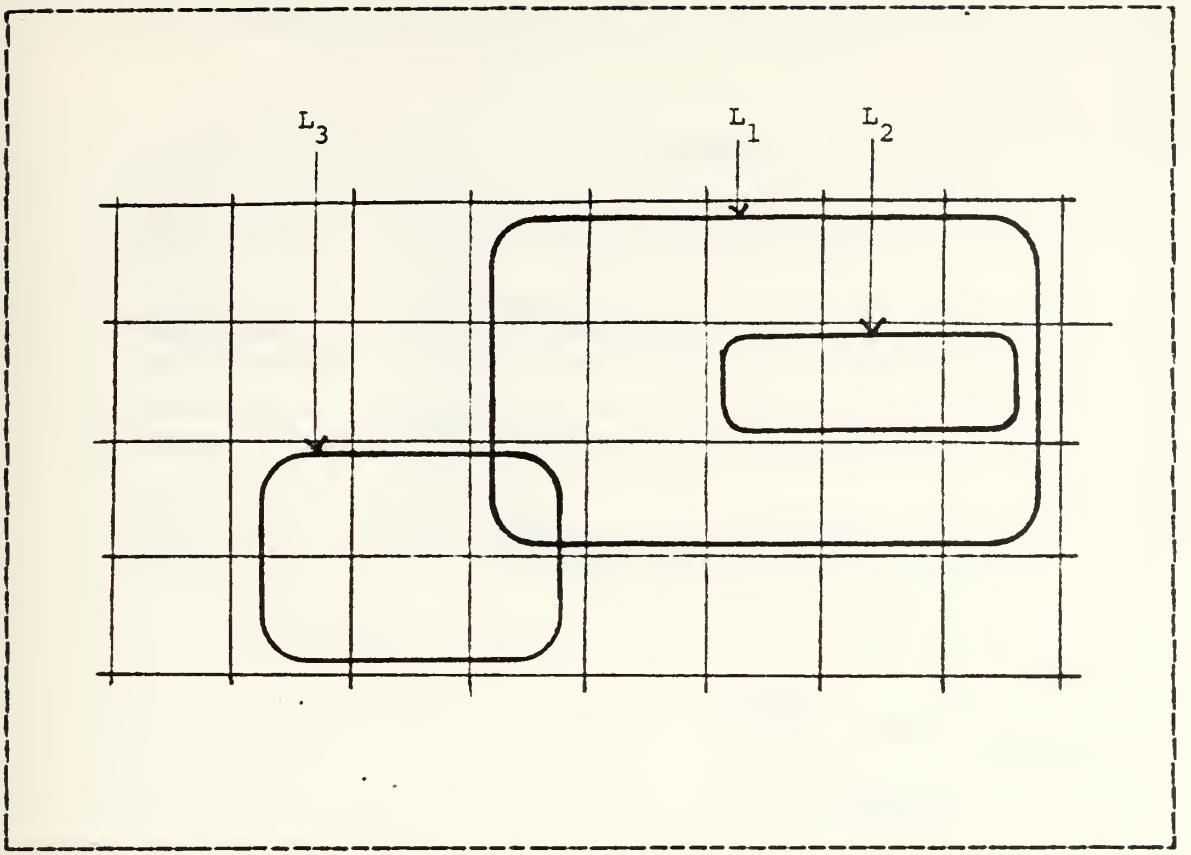


Figure 3.5 Ordering of Security Level.

Access to an object can be through either observing (READ) the object or altering (APPEND) the object, and from this combination we can determine the access type:

* not both
* READ
* APPEND
* WRITE

The multilevel model considers the states of a secure system, which are described by:

1. the current access set, which is a set of triples (subject, object, access type) or (s,o,t),
2. an access matrix,

Element	Interpretation
Subject s	Process
Object o	Data, files, . . .
Classifications	Clearance level of subject, classification level of object
Categories	Access privileges
Security level	(Classification, category set)
Access attribute t	No observe, no alter; observe only, observe and alter; alter only
Access matrix	Discretionary security
Request	Changes current access or other aspects of system state
(s, o, t)	Current access
Decision	Yes, no, error, or ?
Rules	Determine decision, next state

From:
Database Security & Integrity
E.B. Fernandez

Figure 3.6 Elements of the Multilevel Model.

3. the security level of each subject, and
4. the maximum and current security levels of each subject.

1. Requirements to Read Data from a Data Set

A user may read a set of data if, and only if his clearance dominates the classification of a data set. The clearance of user (U) dominates a set of data (D) if, and only if,

military classification (U) > military classification (D)
category (U) $\subseteq$ category (D)
U need-to-know (read D)

2. Requirement to Write Data into a Data Set

A user may not write data into a set of data if the classification of the data he is writing dominates the classification of the data into which he is writing. That is, if the user wishes to write data (d) into data set (D), it is required that

military classification (d) < military classification (D)
category (d) $\supseteq$ category (D)
U need-to-know (write D)

IV. THE MULTICS CONCEPTS

A. GENERAL CONCEPT

The Multiplexed Information and Computing System [Ref. 1] (MULTICS), employs the concept of rings of protection, based on:

1. Need to know, and
2. Firewall, to minimize damage due to errors.

Basically protection of data or objects in Multics is achieved by compartmentalizing all of the stored information into discrete packages called segments, where each is associated with a set of access attributes.

This chapter will discuss the concepts of access control, protection, and filing concepts in Multics, since these filing concepts will be a basis for the implementation of the existing personnel database in the following chapter.

B. ACCESS CONTROL AND PROTECTION

In Multics, compartmentalization [Ref. 11] is achieved through two primary mechanisms:

1. Per-Segment Access Control
2. Concentric Rings of Protection

These mechanisms complement one another.

1. Per-segment Access Control

Per-Segment Access Control is a means of denoting and controlling the type of access to a particular shared segment given to an individual user. A segment may be

shared by two or more processes. The subject who creates the segment and grants permission to share to a user, may specify the type of access to be given to each grantee. By this privilege, Multics guarantees that a user can safeguard the information he creates and files away for future use. Multics permits the coexistence of many processes, each of which competes for the system's physical resources and employs the same file system hierarchy.

The hierarchical directory structure in Multics which controls the file system looks like ordinary file. It includesauthors, users listing and access type permitted to each user which is granted individually. Each author listed in the directory is associated with a file in the access control list (ACL).

2. Concentric Rings of Protection

The ring mechanism, by contrast, offers intraprocess protection of a segment. The concentric-rings concept is essentially a generalization of S (supervisor) and U (user) domains. The segments of any process are associated with a set of generally two or possibly more concentric rings.

A ring procedure prevents any user from referring to inner ring data segments which have higher level classification. A user is permitted to access more privileged procedures only through specially controlled entry points called "gates".

By subsetting the segments of a process into rings and by effectively controlling interactions and communication between segments of different rings (supevisory or userlike), Multics has the potential to isolate trouble and limit the damage in the system. When an outside ring is damaged, this will not effect the inner ring, but damage to the inner ring will cause damage to the outside ring as well.

Ring brackets are associated with accessible segments as shown in Figure 4.1 .

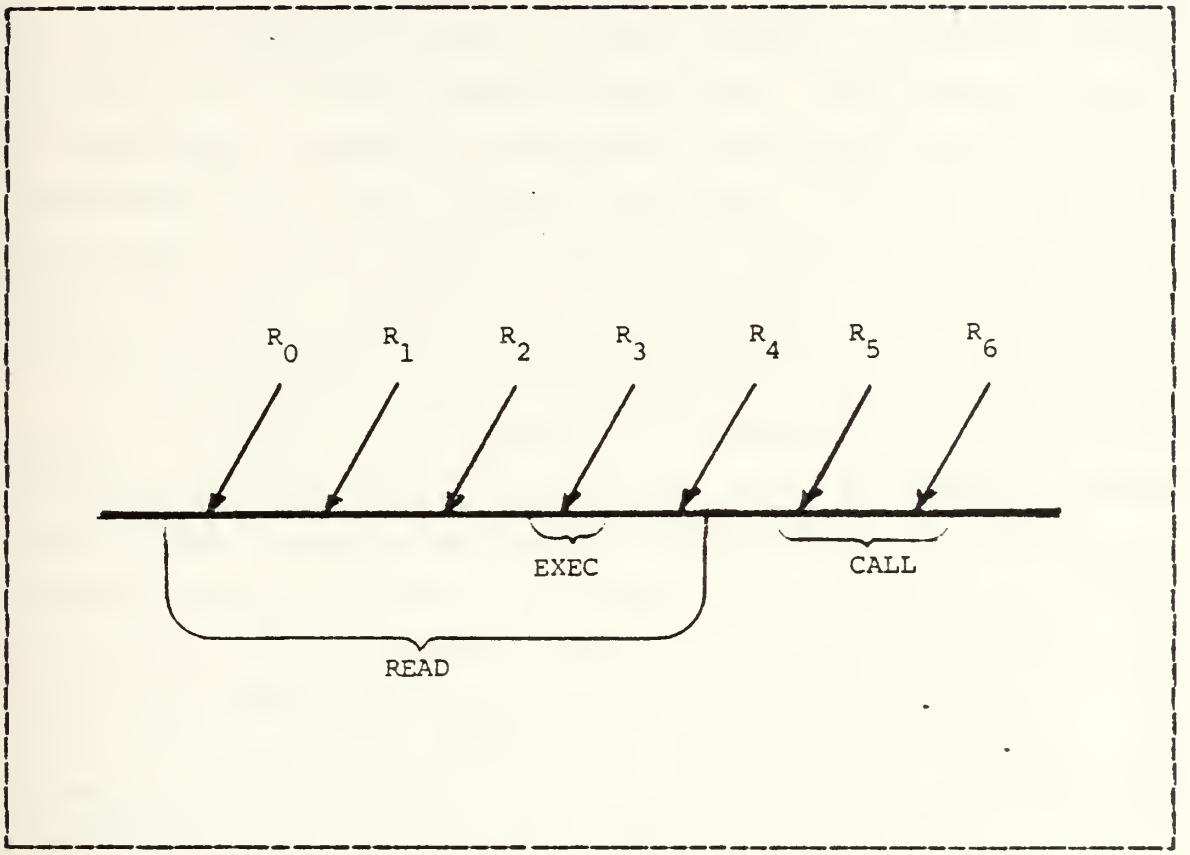


Figure 4.1 Segment Privileges.

Read and Write privileges are always associated with a ring-bracket starting at ring 0. In Figure 4.1 for example, the read bracket is defined as ring 0 to ring 4, which means that if a process is currently being executed in ring 0,1,2,3 or 4, then it may read the segment.

The Call bracket is defined as ring 5 and 6, which means that only when a process is executing in ring 5 or 6 can it call this segment when the segment is being executed, as the process is in ring 3.

In Multics , all storage are organized as named segments, and the segment is the unit of protection. A segment can contain either data or procedures.

A Multics process is usually associated with an end user who is identified by a unique number. In the database context an end user invokes a database application program by combining a number of procedures. Eventually one of these procedures will call a DBMS procedure, which in turn may call other DBMS or operating-system procedures. The user can build protected subsystems by grouping procedures into segments that can then be protected from one another.

Associated with each process is a descriptor segment, which is a vector of segment descriptor words (SDWs) providing addressability to all the segments accessible to the process. A directory system is used to locate a segment when it is first referenced by a process. The directory entry for a segment contains an access-control list specifying which users can access the segment and what their rights are. If the requested access is authorized, the segment is added to the user's virtual memory by adding the appropriate SDW to the user's descriptor segment.

Initially all information is stored in the access-control list. However, when the segment is first referenced, the information is copied into the SDW for the segment. For every subsequent access by the process the SDW alone is checked by hardware to determine whether an access is authorized.

C. MULTICS FILE SYSTEM

The Multics filing system consists of two modules: Segment Control and Directory Control. Here, file and segment are entirely synonymous, since the concept of segment is merely an extension of the concept of file.

The segment Control Module (SCM) interprets the intent of the user's symbolic references to segments. It determines to which, if any, of the segments already known to the process a given symbolic name refers. If none, the Segment Control Module must then determine if a new segment is to be created and placed in the hierarchy.

When using the SCM, a Known Segment Table (KST) is needed to store segments currently part of the process. SCM maintains control over these reference-name-segment-number pairs in a given process. Its job is to develop and reuse each name-number pair in its proper context.

The directory Control Module (DCM) is used to search all inquiries about the status or location of segments and/or their descriptions, because only this module is permitted to read and alter the contents of the directory segments.

1. Directory Structure

This filing system has a directory structure that contains two types of entries which may be added to it:

1. branches and
2. links.

A branch is a detailed description of a segment located in the secondary storage of records that comprise the segment. A link is a special kind of named entry whose purpose is to point to another entry, normally in some (any) other directory. This allows a useful form of cross-referencing capability, to be superimposed over the basic tree structure formed by the branch-type entries. Figure 4.2 shows an example of the conceptual model of the file-system tree structure.

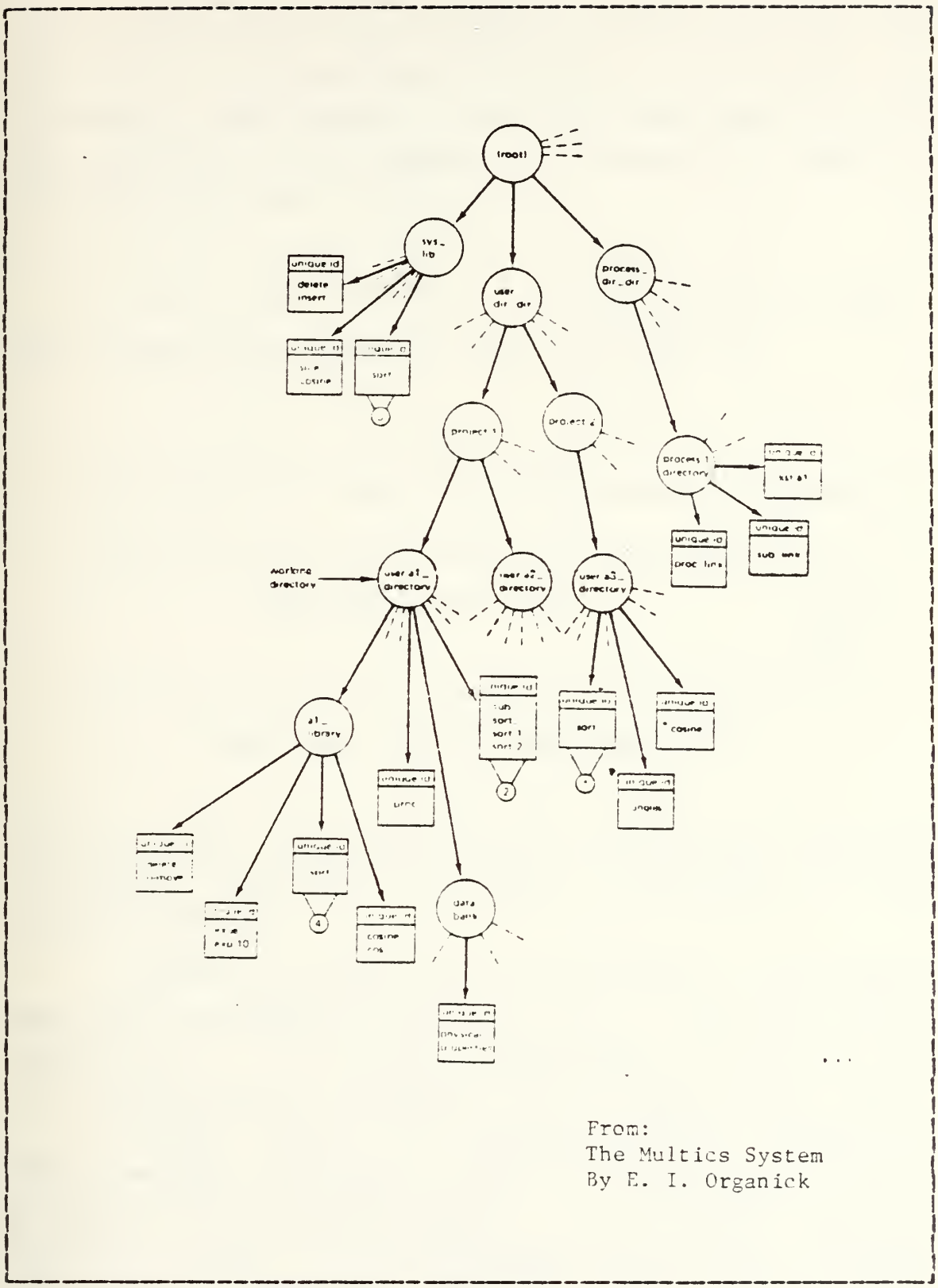
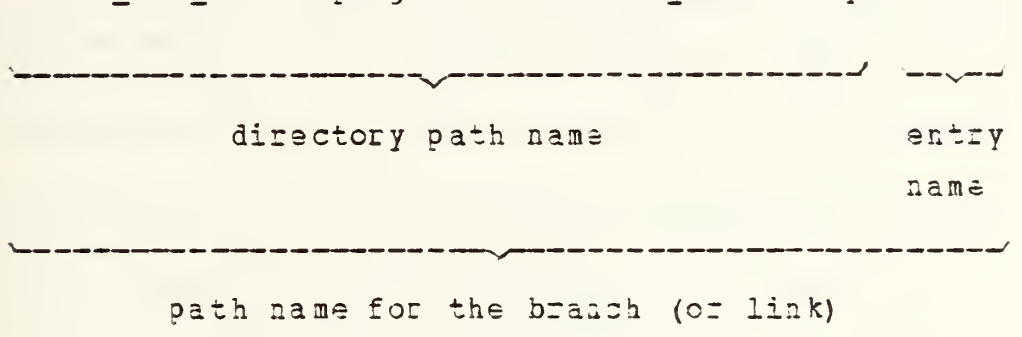


Figure 4.2 Conceptual Model of the File-system Tree Structure.

To reach a certain branch, a certain path is needed using path_name and relative_path_name. A path_name, is a list of the node names from the root to the branch (or link) inclusive, where elements of the list are separated by the ">" character. For example, to search for "sub" the following path name is used:

"> user_dir_dir > project1 > usera1_directory > sub",

and to search for "sort" the path name used is:



In other words, the Multics link is considered a shorthand for symbolic pathname, therefore, it introduces no additional structure.

Figure 4.3 shows that from directory A, the symbolic name "E" is shorthand for " > B > E ". Any path name may begin with " > ", if a path name begins with other than " >', the given path is referred to as a relative path name.

At all times, an executing process is associated with a working directory. This is a directory the process happens to be currently "using". It is merely a reference marker to a point in the hierarchy from which it becomes convenient to describe a relative path to other segments.

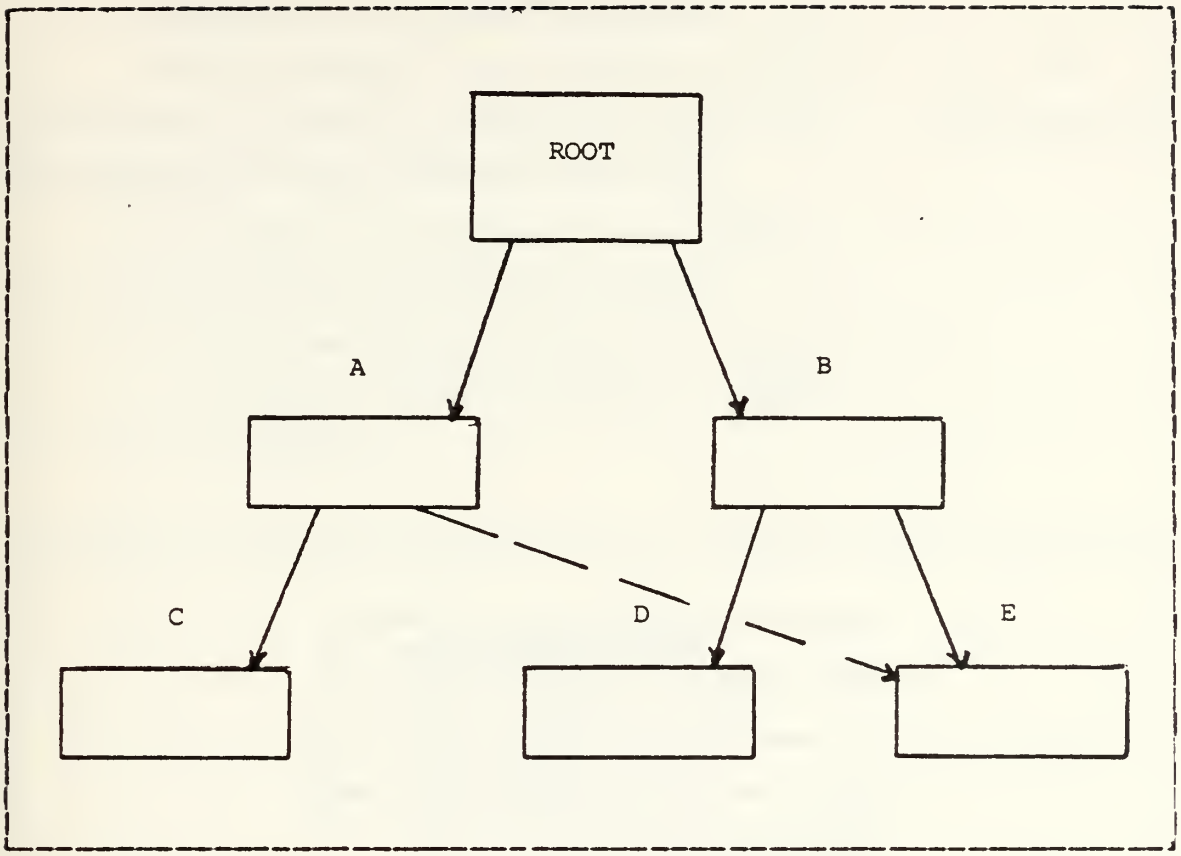


Figure 4.3 Interpretation of Links.

Thus, a tree path to a particular node may be described relative to the working directory of a process. For example referring to Figure 4.2 the path name for sort is simply "sort", and the path name for delete is "a1_library > delete ".

It is also possible to use the relative path-name convention when referring to a branch that is not a descendant of the working directory. This is done with the aid of the character "<". It is interpreted as parent of the working directory. And "<<" would mean parent of parent of the working directory, and so on. For example, relative path name for < usera3_directory > is "<< project2 > usera3_directory" or "user_dir_dir > project2 > usera3_directory"

2. Elements of a Secure Multics

Corresponding to a state (b,M,f,H) is a set of information structure in Multics [Ref. 2]. The following correspondences have been identified:

b - Segment Descriptor Words (SDW)
M - Access Control List (ACL)
f - Information in directory segments and special process security tables
H - Branches

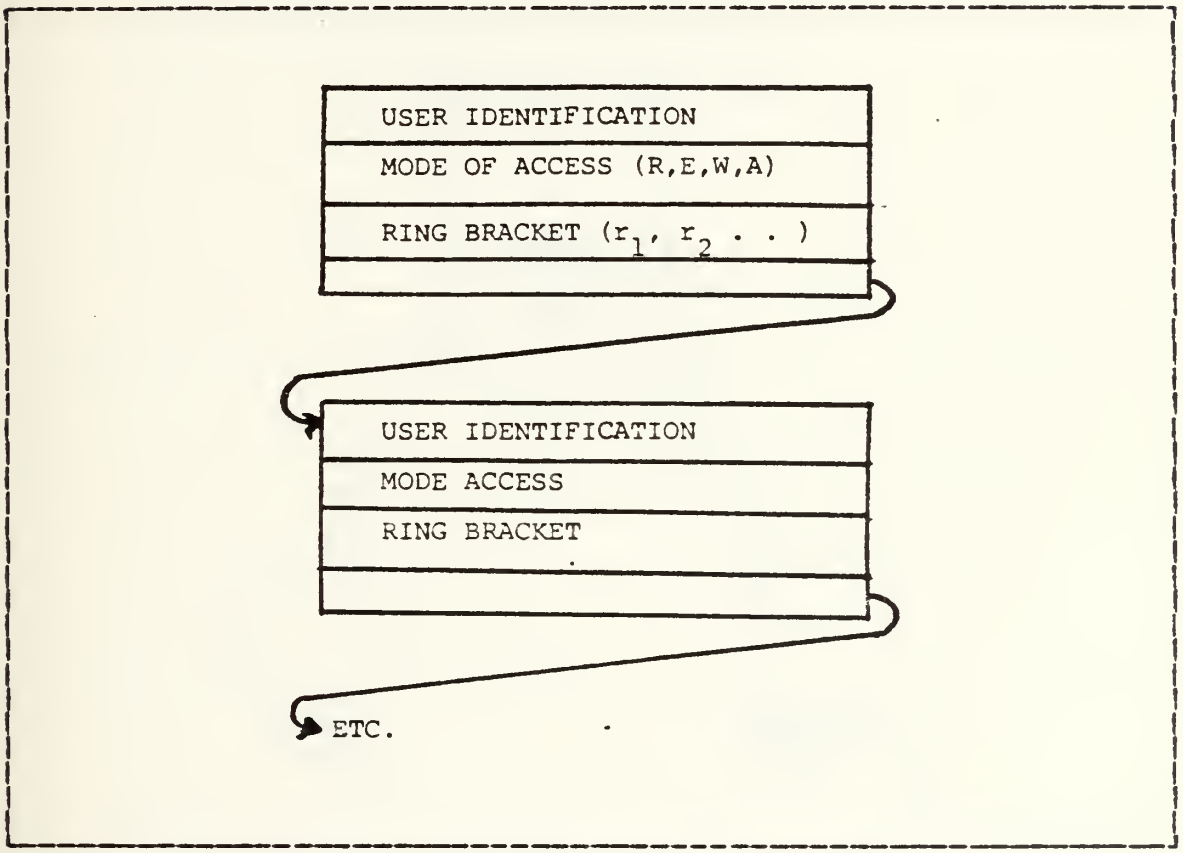


Figure 4.4 Data Structure of an ACL for an Individual Branch.

An element (Si, Oj, x) in b indicates that subject Si has current access to object Oj in access mode x.

In SDW is a field which indicates access permission (write, read, execute, or append)

An entry in M such as { r,w } indicates that subject Si has read and write permission with respect to object Oj, if Oj is a data segment.

As example of the data structure of an access-control list for an individual branch is shown in Figure 4.4.

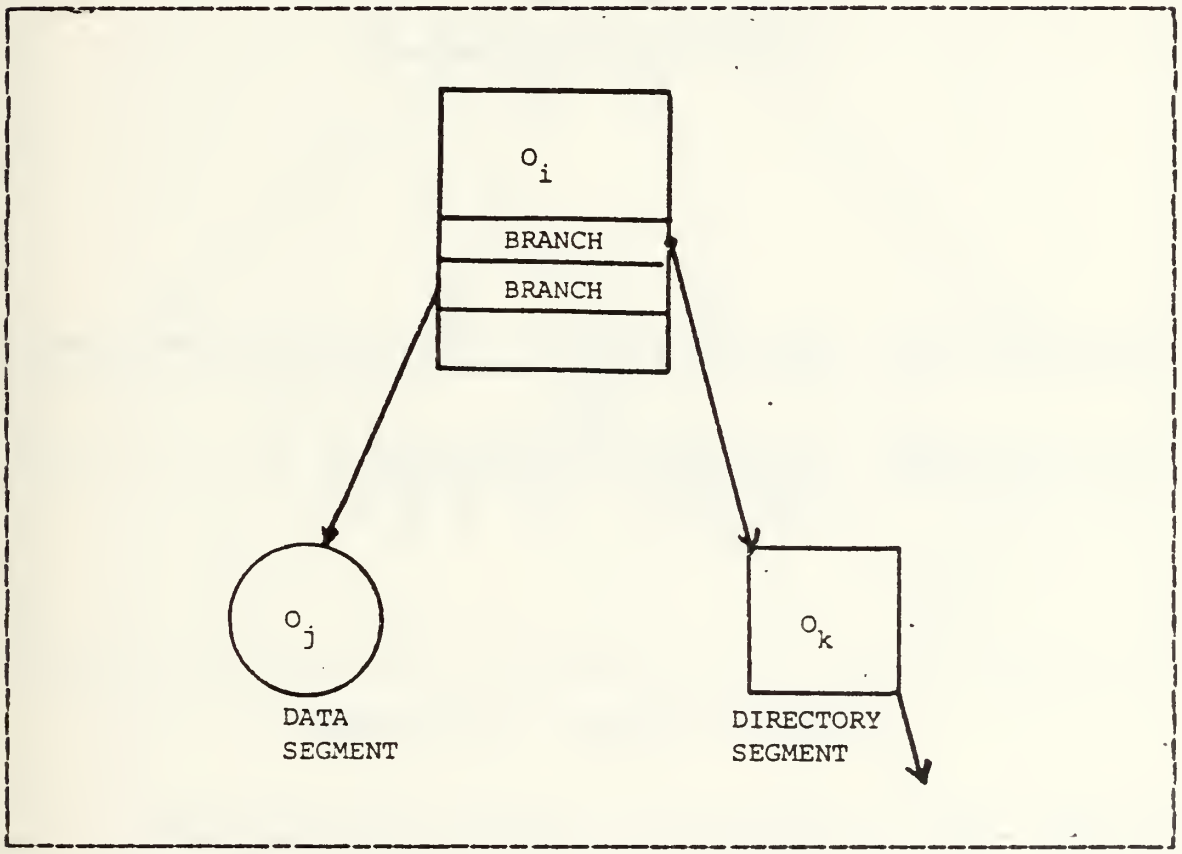


Figure 4.5 Multics Hierarchiy Equivalent.

3. Retrieving File-branch Information

The hierarchy H of the model is structured to reflect the tree structure among segments realized by branches in Multics. If Oi and Oj are objects in the model and H(Oi) includes Oj, then Oi is the parent of Oj. Figure 4.5 shows this situation.

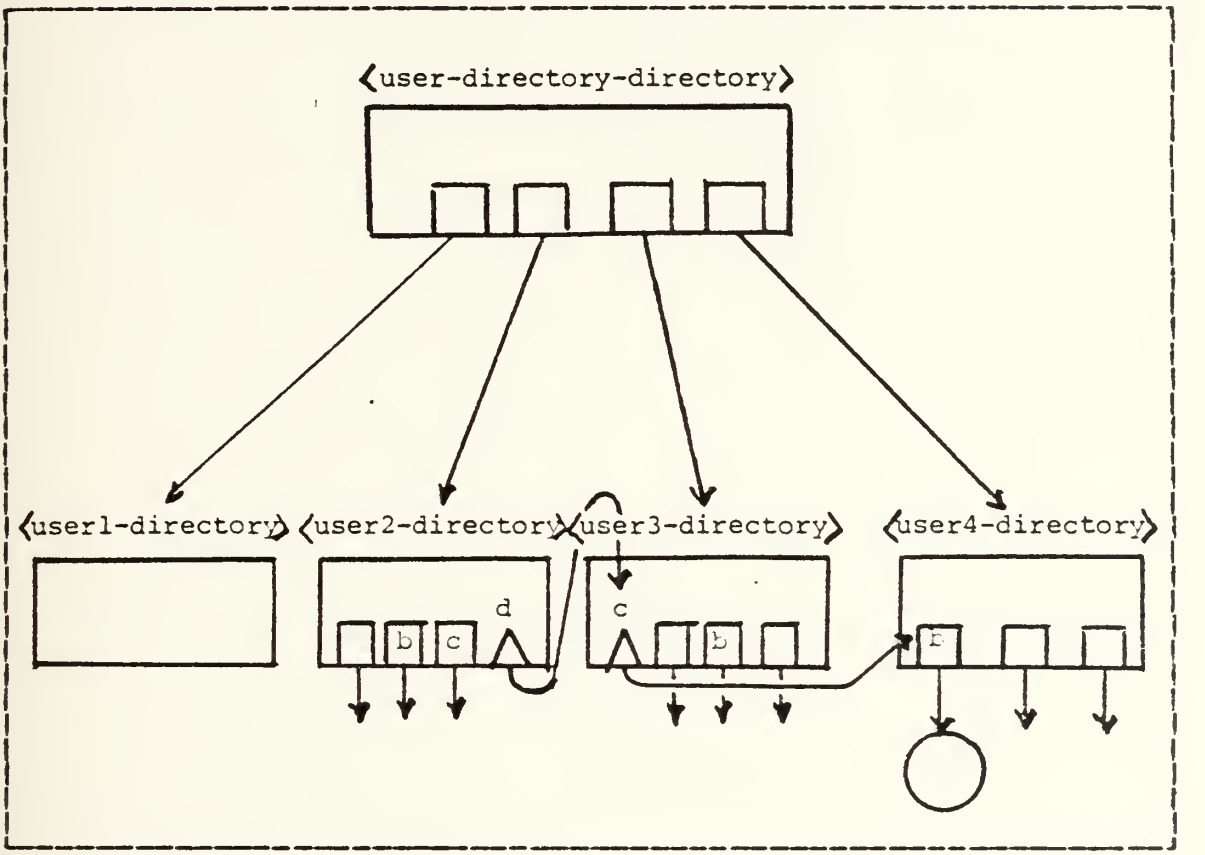


Figure 4.6 Chain of Links.

When directory control is supplied a path name for the purpose of retrieving corresponding file-branch information, the desired directory entry is retrieved by link or branch. If it is a branch, the target has been reached, and if it is a link the path name found in a link is then employed for a repetition of the retrieval process. It is possible that a chain of links evetually leads to a branch.

Figure 4.6 shows how user4 grants permission to user3, and user3 grants permission to user2 to use their routines. If user2 and user3 appear in the access control list for <b> in user4's user directory, then user2 may use "d" as a symbolic reference and user3 may use "c" as a symbolic reference to the segment whose branch entry is named "b".

V. IMPLEMENTATION OF MULTICS IN DATABASE SECURITY

The basic security model including data security in Multics has been discussed in the previous chapter. Before we further discuss the implementation of database security we will take some assumptions as followed: Firstly, although the Multics system was developed and applied to operating systems for Honeywell computers, we will assume that it can also be used by other computers in general.

Secondly, we assume that users in the Indonesian Navy database system are limited to five assistants for Chief of Staff of the Indonesian Navy, namely:

1. Assistant for Security
2. Assistant for Operations
3. Assistant for Personnel
4. Assistant for Logistics
5. Assistant for Planning

The second assumption is needed because there are some offices supervised by the Assistants which currently deal with the personnel database system.

The description of a directory has been discussed in Chapter IV, therefore we will not discuss how to find a segment in this chapter.

The personnel database in the Indonesian Navy is divided into 17 segments. The method proposed here adds 2 segments which are:

Segment 400, which is followed by elements number 401-403, is divided into two, namely segment 400 which is followed by elements number 401 and segment 500 which is followed by elements number 501. This change is needed since element's owners are different.

For the same reason, segment 500 which is followed by elements 501-502, is divided into two segments, namely segment 600 followed by elements number 601-607 and segment 700 followed by elements number 701-705.

All changes are shown in the table in Appendix C.

We can summarize to this point that the personnel database is now divided into 19 segments and there are 5 users, which follow the sequence of assistant staffs. It has been determined who owns each segment, and each owner has the authority to update the contents of his segment(s).

To implement the new security method mentioned above, it is necessary to set up a table containing all segments and their relation to each user. The table tells what segment belongs to whom and what kind of accesses are authorized to other users. In this case the DBA (Database Administrator) can arrange the table in the proper order.

TABLE I
Access Table

ELM #	DATA-NAME	TYPE OF ACCESS S1	S2	S3	S4	S5
100	MAINID	R	R	RWAD	R	R
200	CHARACT	R	_	RWAD	_	_
300	MARR	_	_	RWAD	_	_

400	ADDR	R	_	RWAD	_	_
500	ADDRSTA	_	_	R	RWAD	_
600	BODYCHAR	_	_	RWAD	_	_
700	PERSIZ	_	_	R	RWAD	_
800	CATEG	R	R	RWAD	R	R
900	RANK	R	R	RWAD	R	R
1000	PROFESS	R	R	RWAD	_	R
1100	EDUC	R	R	RWAD	_	R
1200	SUBJ	R	R	RWAD	_	R
1300	FAM	R	_	RWAD	_	_
1400	FACT	R	_	RWAD	_	_
1500	FEDUC	_	_	RWAD	_	_
1600	PAYROLL	_	_	_	RWAD	_
1700	SEC	RWAD	_	_	_	_

1800	WHOINV	RWAD	-	-	-	-
1900	MEAS	RWAD	-	-	-	-

R - read
W - write
A - append
D - delete

Security is divided into 4 levels :

1. Top secret
2. Secret
3. Confidential, and
4. Unclassified

Segment numbers 1700, 1800, and 1900 are in the classified levels and the other segments classifications will be determined in the future, depending on the needs of the Navy.

VI. CONCLUSIONS AND RECOMMENDATIONS

It is justified here to draw some conclusions and make recommendations concerning the importance of personnel database security in the Indonesian Navy.

The conclusions can be described as follows:

1. Database security is very important to any database system, especially in the military.
2. The Multics system provides basic concepts to achieve a sound database security system.
3. The Indonesian Navy personnel database security can be improved by applying such concepts as the one described in this thesis.

In order to implement this security model in the Indonesian Navy database personnel system, it is recommended to:

1. Assign security personnel under the DBA who will be responsible for the security of the existing database.
2. Conduct further research to explore possible enhanchments to the physical design related in this proposal.

APPENDIX A
DATABASE PERSONNEL TABLES

Each of these tables contains two elements: code and description. Example: " 1Male " indicates code number 1 is Male.

1. PERSONAL STATUS:

   A. Military

      01 Volunteer
      02 Obliged
      03 Titular

   B. Civilian

      11 Daily_laborer
      12 Monthly_laborer
      13 Monthly_laborer organic
      14 Temporary Government_official
      15 Pre_Government_official
      16 Civilian_Government_official
      17 Civilian_Military_Titular Government_official

2. PERSONAL CATEGORY:

0 Not clear	5 Waiting for placement
1 Active organic	6 Waiting for direction
2 In charge	7 Pre_retired
3 In assistance	8 Money waiting (UT)
4 In direction	9 Retired

3. SEX:

1 Male	2 Female

4. MARITAL STATUS

1 Married	2 Not married

5. CHILDREN ALLOWANCE STATUS:

1 Claimed by him/ herself	2 Claimed by spouse

6. HOUSING STATUS:

1 Government-quarters	4 Private/owned
2 Mess	5 Rented
3 Ship	6 Contract/leased
7 With relations	

7. BLOOD TYPE:

1 A	4 O
2 B	5 X
3 AB	

8. COLOR OF SKIN:

1 White	4 Yellow-brown
2 Yellow	5 Brown
3 Black	

9. HAIR:

1 Straight-lank	3 Straight-stiff
2 Curly	4 Wavy

10. COLOR OF EYES:

1 Black	3 Brown
2 Blue	4 Green

11. SIZE OF PANTS/SHIRT:

1 Small	3 Large
2 Medium	

12. RELIGION:

1 Moslem	4 Hindu

2 Catholic
3 Protestant
5 Budhist
6 Cofucian

13. STATUS OF RANK:

1 Effective
2 Temporary
3 In education
4 Military obligated
5 Military titular

14. TYPE OF PROMOTION:

1 Regular
2 Extraordinary
3 Honor (meritorious)
4 Honour-grace (posthumous)

15. STATUS OF PLACEMENT:

0 Organic
1 Labor (non organic)
2 In charge (detached from parent command)
3 In assistance (temporary additional duty)
4 In direction (independent duty)

16. RESULT OF EDUCATION:

1 Graduated
2 Not graduated
3 Incomplete.

17. FAMILY RELATION:

0 Spouse
1 Child number 1
2 Child number 2
3 Child number 3
4 Child number 4
5 Child number 5
6 Child number 6
7 Child number 7
8 Child number 8
9 Child number 9

18. RANK:

A. Military:
99 Third Sailor
98 Second Sailor
97 First Sailor
96 Second Corporal

95 First Corporal
88 Second Sergeant
87 First Sergeant
86 Head Sergeant
85 Sergeant Major
84 Second Assistant Lieutenant
83 First Assistant Lieutenant
82 Candidate Officer
78 Second Lieutenant
77 First Lieutenant
76 Captain
68 Major
67 Lieutenant Colonel
66 Colonel
58 First Admiral (Commodore)/Brigadier General
57 Rear Admiral/Major General
56 Vice Admiral/Lieutenant General
55 Admiral/General

B Civilian

48 Group	I/A	27 Group	III/B
47 Group	I/B	26 Group	III/C
46 Group	I/C	25 Group	III/D
45 Group	I/D	18 Group	IV/A
38 Group	II/A	17 Group	IV/B
37 Group	II/B	16 Group	IV/C
36 Group	II/C	15 Group	IV/D
35 Group	II/D	14 Group	IV/E
28 Group	III/A		

19. CORPS:

A. Military

100 Sailor/Deck (for officer only)
161 Deck

162 Torpedo
163 Weapon
164 Constable
165 Signal
166 Telegram
167 Under-Water Weaponry

200 Technician/Engineer (for officer only)
261 Mechanist
262 Construction
263 Ship Construction
264 Airplane Maintenance

300 Electronics (for officer only)
361 Radio
362 Radio-Radar Mechanic
363 Electro-Machine Mechanic
364 Electrician
365 Sub-Weapon Electrician
366 Electro Mechanic
367 Weapon Electro Mechanic
368 Electronica

400 Marine (for officer only)
461 Infantry
462 Amphibious
463 Field Artillery
464 Air Defence Artillery
465 Tank
466 Pansam (Amphibious Tank)
467 Transportation
468 Zipur (Defense Construction)
469 Communication-Electronica
470 Nurse
471 Field Support

500 Administration (for officer only)

561 Writer/Typist
562 Finance
563 Support
564 Family bussiness
565 Cook-1
566 Cook
567 Tailor

600 Health (for officer only)
661 Nurse
662 Radiologist
663 Analyst
664 Dental Technician
665 Chemist
666 Assistant Chemist

700 Specialist (for officer only)
761 Judicature
762 Intelligence
763 Transportation
764 Carpenter
765 Physical Fitness
766 Musician
767 Photography
768 Cinematography
769 Miscellaneous

800 Woman (for officer only)
861 Communication
862 Writer/Typist
863 Finance
864 Information
865 Physical Fitness
866 Nurse
867 Nav-Information Defence
868 Air Traffic Controller

900 Clergy (for officer only)

B. Civilian:

000 Administration
001 General Administration
002 Finance Administration
003 Labor Administration
004 Support Administration
005 Nursing Administration
006 Technical Administration
007 Typist
008 Stencil Mechanic
009 Nursing Staff
010 Statistic Administration
011 Law Administration
012 Library Administration
013 Transportation Administration
014 Housing Administration
015 Post Administration
016 Miscellaneous Administration

017 Technician
018 Ship Technician
019 Engine/Machine Technician
020 Electro Technician
021 Construction Technician
022 Carpenter
023 Welding Technician
024 Telephone-telegraph Technician
025 Radio Technician
026 Mechanic/Driver
027 Laborer
028 Photographer
029 Film Operator

030 Metal Technician
031 Painter
032 Weapon Technician
033 Fire Safety Inpector
034 Constructor
035 General Controller
036 Shipyard Worker
037 Pump Technician
038 Railroad Technician
039 Meteorological Technician
040 Miscellaneous

041 Nurse
042 Dental Nurse
043 General Nursing
044 Midwife
045 Pharmacy
046 Physicthera phy
047 Radiology
048 Pediatric Nurse
049 General Medical
050 Opthalmologist
051 Throat-nose-ear Physician
052 Neurologist
053 Dermatologist
054 Dietitian
055 Miscellaneous

056 Specialist
057 Teacher/Instructor
058 Messenger
059 Cook
060 Gardener
061 Shoemaker
062 Tailor
063 Barber

064 Janitor
065 Forester
066 Sketcher
067 Security
068 Lifeguard
069 Parking Master
070 Fire Brigade
071 Physical Fitness
072 Artist
073 Clergy
074 Laundry
075 Ocean Tide
076 Petro-chemical Technician
077 Geography
078 Miscellaneous

20. GROUP CODE OF EDUCATION:

000 General Development
001 National Defense
002 Joint Command & Staff College
003 Command & Staff College Level
004 2nd Officer Continuing Education Level
005 1st Officer Continuing Education Level
011 NCO Continuing Education Level

100 Formation
101 Military Academy Level
102 Fundamental Officer Education Level
103 Candidate Officer Education Level
111 Candidate NCO Education Level
112 Candidate Corporal Education Level
113 Candidate Enlisted Education Level

200 Labor
201 Labor Education Level

300 General Education

301 University Level

302 Academy Level

303 Senior High School Level

304 Junior High School Level

305 Elementary School Level (graduate)

306 Elementary school level (not graduate)

400 Specialist Military Education

401 Specialist

402 Officer Specialist

403 NCO Specialist

404 Enlisted Specialist

405 Civilian Specialist

500 General Course

21. ECHELON OF PROFESSION:

11 Echelon 1-A	23 Echelon 2-C
12 Echelon 1-B	24 Echelon 2-D
13 Echelon 1-C	25 Echelon 2-E
14 Echelon 1-D	26 Echelon 2-F
15 Echelon 1-E	31 Echelon 3-A
16 Echelon 1-F	32 Echelon 3-B
17 Echelon 1-G	33 Echelon 3-C
18 Echelon 1-H	34 Echelon 3-D
21 Echelon 2-A	35 Echelon 3-E
22 Echelon 2-B	40 Functional

22. STATION:

Not include here for security reasons.

23. VIOLATION:

1 Discipline	3 Negative data
2 Law	

24. WHAT:

This table will be completed later by an Intelligence/Security officer, since the author does not have data at this time.

APPENDIX B
DATABASE DICTIONARY

This data dictionary contains descriptions of the Personnel Data Base segments (data elements groups) and their data elements. There are six columns in the table:

1. Element Number (ELM #). The data element/segment number contains four digits. The first two digits is the segment number, beginning from the root and increasing by one (leading zeroes suppressed), and another two digits for the data element number in the segment beginning from one and increasing by one.

2. Data Element (DATA_ELEMENT). This column contains data element/segment name as it is known to the users.

3. Data Name (DATA_NAME). This column contains the unique name for data element/segment which is to be used by programmer/user when retrieving data from the Database.

4. Type (TYPE). This column contains the data element's type where N means Numeric and AN means Alpha-Numeric.

5. Number of Character (OF CHAR). This column cotains number of characters in the record field of the data element/segment.

6. Description (DESCRIPTION). This column contains the description of the data element/segment. Described are the data element/segment relationships (dependent, root, etc.), key record/segment, administrative

control, usage, and identifications. This description helps the programmer/ user to find the path to desire data elements/segments in the database.

The abbreviations used in the data dictionary table are: DB for Database, segm for segmen, lev for level, tbl for table. YYMMDD for Year (two digits), Month (two digits) and Date (two digits), occur for occurrence, dependt for dependent, Kg for Kilogram, and Cm for Centimeter.

ELM #	DATA-ELEMENT	DATA-NAME	TY-PE	#OF CHAR	DESCRIPTION
100	Main identification	MAINID		76	Root segm DB lev 1, segm 1, one occur
101	Personal Serial Number	SERNUM	N	9	Record key (Main Key)
102	Name	NAME	AN	26	Name, title
103	Corps	CORPS	N	3	See corps tbl (19)
104	Sex	SEX	N	1	See sex tbl (3)
105	Birth date	DMBIRTH	N	6	YYMMDD
106	Birth place	PMBIRTH	AN	15	Town (city)
107	Religion	RELIGION	N	1	See religion tbl (12)
108	Tribe	TRIBE	AN	15	-
200	Personal	CHARACT			Dependt segm of root, lev 1, segm 2, one occur

300	Marriage	MARR		7	Dependt segm of CHARACT, lev 3, segm 3, repeated
301	Marital status	MARST	N	1	See marital status tbl (4) segm key
302	Date of status	MARDT	N	6	YYMMDD
400	Address	ADDR		33	Dependt segm of CHARACT, lev 3, segm 4, repeated
401	Address	ADDRESS	AN	26	-
402	Housing status	HOUSE	N	1	See housing status tbl (6) segm key
403	Date of status	HOUSDT	N	6	YYMMDD
500	Body charachteristic	BODYCHAR		18	Dependt segm of CHARACT, lev 3, segm 5, one occur
501	Weight	WEIGHT	N	3	In Kg
502	Height	HEIGHT	N	3	In Cm
503	Blood type	BLOOD	N	1	See blood type tbl (7), segm key
504	Color of skin	SKIN	N	1	See color of skin tbl (8)
505	Hair	HAIR	N	1	See hair tbl (9)
506	Color of eyes	EYES	N	1	See color of

					eyes tbl (10)
507	Size of shoes	SHOES	N	2	-
508	Size of hat	HAT	N	2	-
509	Size of pants	PANTS	N	1	See pant shirt tbl (11)
510	Size of shirt	SHIRT	N	1	See pant shirt tbl (11)
511	Size of chest	CHEST	N	2	-
600	Category and status	CATEG		29	Dependt segm of CHARACT, lev 3, segm 6, one occur
601	Original personal status	ORPERST	N	2	See personal status tbl (1)
602	Date of original personal status	ORPERDT	N	6	YYMMDD
603	Current personal status	CRPERST	N	2	See personal status tbl (1) segm key
604	Date of current personal status	CRPERDT	N	6	YYMMDD
605	Personal category	CATEGORY	N	1	See personal category tbl (2)
606	Date of personal category	DTGORY	N	6	YYMMDD
607	Active duty obligated time (Active service duty began)	DTACT	N	6	YYMMDD
700	Rank	RANK		39	Dependt segm of

					root, lev 2, segm 3, repeated
701	Rank/Group	RANKG	N	2	See rank tbl (18), segm key
702	Status of rank	STRANK	N	1	See status of rank tbl (13)
703	Date of rank	DTRANK	N	6	YYMMDD
704	Number of decision letter	NBDECLET	AN	8	Format: NNNNMMYY NNNN : Number MM : Month YY : Year
705	Date of decision letter	DTDECLET	N	6	YYMMDD
706	Who gave the decision letter	GVDECLET	AN	15	Official functionary
707	Type of promotion	TPPROM	N	1	See type of promotion tbl (14)
800	Profession	PROFESS		71	Dependt segm of root, lev 2, segm 4, repeated
801	Name of profession	NMPROF	AN	15	-
802	Number of decision	NBDECP	AN	8	Format: NNNNMMYY NNNN : Number MM : Month YY : Year
803	Date of decision letter	DTPROF	N	6	NNNNNN-YYMMDD
804	Number of professional warrant	NBWARP	AN	8	Format: NNNNMMYY NNNN : Number MM : Month YY : Year

805	Date of warrant	DTWARP	N	6	NNNNNN-YYMMDD
806	Echelon of profession	ECHELON	N	2	See echelon tbl (21)
807	Station	STATION	N	3	See station tbl (22)
808	Reporting date	DTSTAT	N	6	YYMMDD
809	Status of placement	STPLACE	N	1	See status of placement tbl (15)
810	Date of placement	DTPLACE	N	6	YYMMDD
900	Education	EDUC		73	Dependt segm of root, lev 2, segm 9, repeated
901	Group code of education	EDUCCD	N	3	See group code of education tbl (20), segm key
902	Education Institute's Name	EDUCNM	AN	15	-
903	Start date	EDUCSD	N	6	YYMMDD
904	Completion date	EDUCCM	N	6	YYMMDD
905	Station	EDSTAT	N	3	See station tbl (22)
906	Town (city)	EDTOWN	AN	15	-
907	Result of education	RESULT	N	1	See result of education tbl (16)
908	Class standing	CSTAND	N	3	-
909	Class size	CSIZE	N	3	-
1000	Subject	SUBJ		18	Dependt segm of EDUC, lev 3,

					segm 10, repeated
1001	Subject name	SUBJECT	AN	15	Segm key
1002	Grade	GRADE	AN	3	Can be numeric or alphabetic
1100	Family	FAM		76	Dependt segm of root, lev 2, segm 6, repeated
1101	Family name	FNAME	AN	26	Name, title
1102	Family relation	FREL	N	1	See family relation tbl (17), segm key
1103	Sex	FSEX	N	1	See sex tbl (3)
1104	Birth date	FDBIRTH	N	6	YYMMDD
1104	Birth place	FPBIRTH	AN	15	Town (city)
1105	Religion	FPRELIGI	N	1	See religion tbl (12)
1107	Address	FADDR	AN	26	-
1200	Activity	FACT		48	Dependt segm of FAM, lev 3, repeated
1201	Name of activity	FNACT	AN	26	Segm key
1202	Place of activity	FPACT	AN	15	Town (city)
1203	Start date	FSACT	N	6	YYMMDD
1204	Completion date	FCACT	N	6	YYMMDD
1300	Family education	FEDUC		16	Dependt segm of FAM, lev 3, segm 13, repeated

1301	Education Institute's Name	FEDNACT	AN	15	-
1302	Group code of education	FCDACT	N	3	See group code of education tbl (20), segm key
1303	Result of education	FEDRES	N	1	See result of education tbl (16)
1400	Payroll	PAYROLL		59	Dependt segm of root, lev 2, segm 14, one occurr
1401	Date of begining payroll	DBPAY	N	6	YYMMDD
1402	Rank in payroll	RKPAY	N	2	See rank tbl (18)
1403	Payroll period	PERPAY	N	3	In Month
1404	Number of children authorized family allowence	CHFAM	N	1	-
1405	Status of children authorized family allowence	STCHFAM	N	1	See children allowance status tbl (5)
1406	Main salary	MAINSAL	N	6	In Rupiah
1407	Wife's family allowance	WFALL	N	5	In Rupiah
1408	Children family allowance	CHALL	N	5	In Rupiah
1409	Other family allowance	OTALL	N	5	In Rupiah
1410	Obligated reduction	OBRED	N	5	In Rupiah

1411	Rice reduction	RCRED	N	5	In Rupiah
1412	Other reduction	OTRED	N	5	In Rupiah
1413	Total salary	TOTSAL	N	6	In Rupiah
1414	Unit of payroll	UNPAY	N	4	See station tbl (22), segm key
1500	Security	SEC		35	Dependt segm of root, lev 2, segm 15, repeated
1501	Violation/Infringe	VTYPE	N	1	See violation/ infringe type tbl (23), segm key
1502	What	WHAT	N	3	See what tbl (24)
1503	Where	WHERE	AN	15	Town (city)
1504	When	WHEN	N	6	YYMMDD
1505	Why	WHY	N	5	This reason description is stored in other file with key number here (N 5)
1506	How	HOW	N	5	Same as 1505
1600	Who involved	WHOINV		50	Dependt segm of SEC, lev 3, segm 16, repeated
1601	Name involved	INVNAME	AN	26	Segm key
1602	Personal	PERSID	AN	9	Personal serial

	identification				number or other valid identification
1603	Profession	PROFINV	AN	15	-
1700	Measures	MEAS		27	Dependt segm of SEC, lev 3, segm 16, repeated
1701	Type of action	NMEAS	AN	15	Segm key
1702	Start date	SMEAS	N	6	YYMMDD
1703	Completion date	CMEAS	N	6	YYMMDD

APPENDIX C
NEW DATABASE DICTIONARY

This data dictionary contains descriptions of the Personnel Data Base segments (data elements groups) and their data elements. There are six columns in the table: (See Appendix B for abbreviations)

ELM #	DATA-ELEMENT	DATA-NAME	TY-PE	#OF CHAR	DESCRIPTION
100	Main identification	MAINID		76	Root segm DB lev 1, segm 1, one occur
101	Personal Serial Number	SERNUM	N	9	Record key (Main Key)
102	Name	NAME	AN	26	Name, title
103	Corps	CORPS	N	3	See corps tbl (19)
104	Sex	SEX	N	1	See sex tbl (3)
105	Birth date	DMBIRTH	N	6	YYMMDD
106	Birth place	PMBIRTH	AN	15	Town (city)
107	Religion	RELIGION	N	1	See religion tbl (12)
108	Tribe	TRIBE	AN	15	-
200	Personal	CHARACT			Dependt segm of root, lev 1, segm 2, one

					occur
300	Marriage	MARR		7	Dependt segm of CHARACT, lev 3, segm 3, repeated
301	Marital status	MARST	N	1	See marital status tbl (4) segm key
302	Date of status	MARDT	N	6	YYMMDD
400	Address	ADDR		26	Dependt segm of CHARACT, lev 3, segm 4, repeated
401	Address	ADDRESS	AN	26	-
500	Address status	ADDRSTA		7	Dependt segm of ADDR, lev 4, segm 5, repeated
501	Housing status	HOUSE	N	1	See housing status tbl (6) segm key
502	Date of status	HOUSDT	N	6	YYMMDD
600	Body charachteristic	BODYCHAR		10	Dependt segm of CHARACT, lev 3, segm 6, one occur
601	Weight	WEIGHT	N	3	In Kg
602	Height	HEIGHT	N	3	In Cm
603	Blood type	BLOOD	N	1	See blood type tbl (7), segm

					key
604	Color of skin	SKIN	N	1	See color of skin tbl (8)
605	Hair	HAIR	N	1	See hair tbl (9)
606	Color of eyes	EYES	N	1	See color of eyes tbl (10)
700	Personal size	PERSIZ		8	Dependt segm of BODYCHAR, level 4, segm 7, one occur
701	Size of shoes	SHOES	N	2	-
702	Size of hat	HAT	N	2	-
703	Size of pants	PANTS	N	1	See pant shirt tbl (11)
704	Size of shirt	SHIRT	N	1	See pant shirt tbl (11)
705	Size of chest	CHEST	N	2	-
800	Category and status	CATEG		29	Dependt segm of CHARACT, lev 3, segm 8, one occur
801	Original personal status	ORPERST	N	2	See personal status tbl (1)
802	Date of original personal status	ORPERDT	N	6	YYMMDD
803	Current personal status	CRPERST	N	2	See personal status tbl (1) segm key
804	Date of current personal status	CRPERDT	N	6	YYMMDD

805	Personal category	CATEGORY	N	1	See personal category tbl (2)
806	Date of personal category	DTGORY	N	6	YYMMDD
807	Active duty obligated time (Active service duty began)	DTACT	N	6	YYMMDD
900	Rank	RANK		39	Dependt segm of root, lev 2, segm 9, repeated
901	Rank/Group	RANKG	N	2	See rank tbl (18), segm key
902	Status of rank	STRANK	N	1	See status of rank tbl (13)
903	Date of rank	DTRANK	N	6	YYMMDD
904	Number of decision letter	NBDECLET	AN	8	Format: NNNNMMYY NNNN : Number MM : Month YY : Year
905	Date of decision letter	DTDECLET	N	6	YYMMDD
906	Who gave the decision letter	GVDECLET	AN	15	Official functionary
907	Type of promotion	TPPROM	N	1	See type of promotion tbl (14)
1000	Profession	PROFESS		71	Dependt segm of root, lev 2, segm 10,

					repeated
1001	Name of profession	NMPROF	AN	15	-
1002	Number of decision	NBDECP	AN	8	Format: NNNNMMYY NNNN : Number MM : Month YY : Year
1003	Date of decision letter	DTPROF	N	6	NNNNNN-YYMMDD
1004	Number of professional warrant	NBWARP	AN	8	Format: NNNNMMYY NNNN : Number MM : Month YY : Year
1005	Date of warrant	DTWARP	N	6	NNNNNN-YYMMDD
1006	Echelon of profession	ECHELON	N	2	See echelon tbl (21)
1007	Station	STATION	N	3	See station tbl (22)
1008	Reporting date	DTSTAT	N	6	YYMMDD
1009	Status of placement	STPLACE	N	1	See status of placement tbl (15)
1010	Date of placement	DTPLACE	N	6	YYMMDD
1100	Education	EDUC		73	Dependt segm of root, lev 2, segm 11, repeated
1101	Group code of education	EDUCCD	N	3	See group code of education tbl (20), segm key
1102	Education Institute's Name	EDUCNM	AN	15	-

1103	Start date	EDUCSD	N	6	YYMMDD
1104	Completion date	EDUCCM	N	6	YYMMDD
1105	Station	EDSTAT	N	3	See station tbl (22)
1106	Town (city)	EDTOWN	AN	15	-
1107	Result of education	RESULT	N	1	See result of education tbl (16)
1108	Class standing	CSTAND	N	3	-
1109	Class size	CSIZE	N	3	-
1200	Subject	SUBJ		18	Dependt segm of EDUC, lev 3, segm 12, repeated
1201	Subject name	SUBJECT	AN	15	Segm key
1202	Grade	GRADE	AN	3	Can be numeric or alphabetic
1300	Family	FAM		76	Dependt segm of root, lev 2, segm 13, repeated
1301	Family name	FNAME	AN	26	Name, title
1302	Family relation	FREL	N	1	See family relation tbl (17), segm key
1303	Sex	FSEX	N	1	See sex tbl (3)
1304	Birth date	FDBIRTH	N	6	YYMMDD
1304	Birth place	FPBIRTH	AN	15	Town (city)
1305	Religion	FPRELIGI	N	1	See religion tbl (12)
1307	Address	FADDR	AN	26	-

1400	Activity	FACT		48	Dependt segm of FAM, lev 3, segm 14 repeated
1401	Name of activity	FNACT	AN	26	Segm key
1402	Place of activity	FPACT	AN	15	Town (city)
1403	Start date	FSACT	N	6	YYMMDD
1404	Completion date	FCACT	N	6	YYMMDD
1500	Family education	FEDUC		16	Dependt segm of FAM, lev 3, segm 15, repeated
1501	Education Institute's Name	FEDNACT	AN	15	-
1502	Group code of education	FCDACT	N	3	See group code of education tbl (20), segm key
1503	Result of education	FEDRES	N	1	See result of education tbl (16)
1600	Payroll	PAYROLL		59	Dependt segm of root, lev 2, segm 16, one occurr
1601	Date of begining payroll	DBPAY	N	6	YYMMDD
1602	Rank in payroll	RKPAY	N	2	See rank tbl

					(18)
1603	Payroll period	PERPAY	N	3	In Month
1604	Number of children authorized family allowence	CHFAM	N	1	-
1605	Status of children authorized family allowence	STCHFAM	N	1	See children allowance status tbl (5)
1606	Main salary	MAINSAL	N	6	In Rupiah
1607	Wife's family allowance	WFALL	N	5	In Rupiah
1608	Children family allowance	CHALL	N	5	In Rupiah
1609	Other family allowance	OTALL	N	5	In Rupiah
1610	Obligated reduction	OBRED	N	5	In Rupiah
1611	Rice reduction	RCRED	N	5	In Rupiah
1612	Other reduction	OTRED	N	5	In Rupiah
1613	Total salary	TOTSAL	N	6	In Rupiah
1614	Unit of payroll	UNPAY	N	4	See station tbl (22), segm key
1700	Security	SEC		35	Dependt segm of root, lev 2, segm 17, repeated
1701	Violation/Infringe	VTYPE	N	1	See violation/ infringe type tbl (23), segm key
1702	What	WHAT	N	3	See what tbl (24)
1703	Where	WHERE	AN	15	Town (city)

1704	When	WHEN	N	6	YYMMDD
1705	Why	WHY	N	5	This reason description is stored in other file with key number here (N 5)
1706	How	HOW	N	5	Same as 1505
1800	Who involved	WHOINV		50	Dependt segm of SEC, lev 3, segm 18, repeated
1801	Name involved	INVNAME	AN	26	Segm key
1802	Personal identification	PERSID	AN	9	Personal serial number or other valid identification
1803	Profession	PROFINV	AN	15	-
1900	Measures	MEAS		27	Dependt segm of SEC, lev 3, segm 19, repeated
1901	Type of action	NMEAS	AN	15	Segm key
1902	Start date	SMEAS	N	6	YYMMDD
1903	Completion date	CMEAS	N	6	YYMMDD

LIST OF REFERENCES

1. Adleman N. Effects of Producing a Multics Security Kernel, Virginia: HoneyweII Information Systems, Inc., 1975

2. Bell D. E., and La Padula L. J. Secure Computer System: Unified Exposition and Multics Interpretation Virginia: HoneyweII Information systems, Inc., 1976.

3. Date C. J. An Introduction to Database System. Philippines: Addison-Wesley Publisher co., Inc., 1981.

4. Downs D. and Popeck G. J. A Kernel Design for a Secure Database Management System. IEEE, pp. 507-514, October 1977.

5. Fernandez E. B, Summers R. C, and Wood C. Database Security and Integrity. Philippines: Addison-Wesley Publishing Co.,Inc., 1981.

6. Hinke T. H., and Schaefer M. Secure Data Management System. California: System Development Corp.,Santa Monica, 19765

7. Inmon W. H. Effective Database Design. New Jersey: Prentice-Hall, Inc., 1975.

8. Kroenke, David. Database Processing, fundamentals, modeling, applications. Chicago: Science Research Associates, Inc.,1977.

9. Madnicks S. E, Donovan J. J. Operating Systems. New York: McGraw-Hill, Inc., 1977.

10. Moedjiono, The Preliminary Personnel Database Design for the Indonesian Navy. M.S. Thesis Naval Postgraduate School, Monterey, 1982.

11. Organick E. I. The Multics System. Massachusetts: The M.I.T. Press, 1972.

12. Price W. R., Ericksen D. P., Multics Security Integration Requirements. Virginia: HoneyweII Information Systems, Inc., 1976.

13. Price W. R, and Eriksen D. P. Multics Security Kernel Top Level Specification. Virginia: Honeywell Information systems, Inc., 1976.

14. Wormington T. D., and Giesler C. E., Secure DBMS. New York: Rome Air Force Development Center, Air Force System Command, Griffis Air Force Base, 1982.

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